

CLAIMS

What is claimed is:

- 5 1. A truncated sTNFR having the following
formula:
R₁-[Cys¹⁹-Cys¹⁰³]-R₂
wherein [Cys¹⁹-Cys¹⁰³] represents residues 19 through
103 of sTNFR-I, the amino acid residue numbering scheme
10 of which is provided in Figure 1 (SEQ ID NO:2) to
facilitate the comparison;
wherein R₁ represents a methionylated or
nonmethionylated amine group of Cys¹⁹ or of amino-
terminus amino acid residue(s) selected from the group:

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C
IC
SIC
NSIC (SEQ ID NO:15)
NNSIC (SEQ ID NO:16)
QNNSIC (SEQ ID NO:17)
PQNNSIC (SEQ ID NO:18)
HPQNNSIC (SEQ ID NO:19)
IHPQNNSIC (SEQ ID NO:20)
YIHPQNNSIC (SEQ ID NO:21)
KYIHPQNNSIC (SEQ ID NO:22)
GKYIHPQNNSIC (SEQ ID NO:23)
QGKYIHPQNNSIC (SEQ ID NO:24)
PQGKYIHPQNNSIC (SEQ ID NO:25)
CPQGKYIHPQNNSIC (SEQ ID NO:26)
VCPQGKYIHPQNNSIC (SEQ ID NO:27)
SVCPQGKYIHPQNNSIC (SEQ ID NO:28)
DSVCPQGKYIHPQNNSIC (SEQ ID NO:29);

and wherein R₂ represents a carboxy group of Cys¹⁰³ or of carboxy-terminal amino acid residues selected from the group:

F
FC
FCC
FCCS (SEQ ID NO:30)
FCCSL (SEQ ID NO:31)
FCCSLC (SEQ ID NO:32)
FCCSLCL (SEQ ID NO:33);

5 and variants and derivatives thereof, provided however, when R₁ represents a methionylated or nonmethionylated amine group of amino acid sequence VCPQGKYIHPQNNSIC or an N-terminal truncation thereof of from 1 to 15 residues, then R₁-[Cys¹⁹-Cys¹⁰³]-R₂ is not an addition
10 variant having the formula R₁-[Cys¹⁹-Cys¹⁰³]-FCCSLCL-R₃, wherein R₃ represents a carboxyl group of amino acid residues Asn¹¹¹-Asn¹⁶¹ of Figure 1 or a carboxy-terminal truncation of Asn¹¹¹-Asn¹⁶¹ of Figure 1.

15 2. The tumor necrosis binding protein according to Claim 1, selected from the group consisting of sTNFR-I 2.6D/C105, sTNFR-I 2.6D/C106, sTNFR-I 2.6D/N105, sTNFR-I 2.3D/d8, sTNFR-I 2.3D/d18 and sTNFR-I 2.3D/d15 or a variant or derivative thereof.

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3. A truncated sTNFR having the following formula:

R₄-[Cys³²-Cys¹¹⁵]-R₅

wherein [Cys³²-Cys¹¹⁵] represents residues Cys³² through
25 Cys¹¹⁵ of mature, full-length 40kDa TNF inhibitor, the amino acid residue numbering scheme of which is provided in Figure 8 (SEQ ID NO:35) to facilitate the comparison;

wherein R₄ represents a methionylated or nonmethionylated amine group of Cys³² or of amino-terminus amino acid residue(s) selected from the group:

C
MC
QMC
AQMC (SEQ ID NO:36)
TAQMC (SEQ ID NO:37)
QTAQMC (SEQ ID NO:38)
DQTAQMC (SEQ ID NO:39)
YDQTAQMC (SEQ ID NO:40)
YYDQTAQMC (SEQ ID NO:41)
EYYDQTAQMC (SEQ ID NO:42)
REYYDQTAQMC (SEQ ID NO:43)
LREYYDQTAQMC (SEQ ID NO:44)
RLREYYDQTAQMC (SEQ ID NO:45)
CRLREYYDQTAQMC (SEQ ID NO:46)
TCRLREYYDQTAQMC (SEQ ID NO:47)
STCRLREYYDQTAQMC (SEQ ID NO:48)
GSTCRLREYYDQTAQMC (SEQ ID NO:49)
PGSTCRLREYYDQTAQMC (SEQ ID NO:50)
EPGSTCRLREYYDQTAQMC (SEQ ID NO:51)
PEPGSTCRLREYYDQTAQMC (SEQ ID NO:52)
APEPGSTCRLREYYDQTAQMC (SEQ ID NO:53)
YAPEPGSTCRLREYYDQTAQMC (SEQ ID NO:54)
PYAPEPGSTCRLREYYDQTAQMC (SEQ ID NO:55)
TPYAPEPGSTCRLREYYDQTAQMC (SEQ ID NO:56)
FTPYAPEPGSTCRLREYYDQTAQMC (SEQ ID NO:57)
AFTPYAPEPGSTCRLREYYDQTAQMC (SEQ ID NO:58)
VAFTPYAPEPGSTCRLREYYDQTAQMC (SEQ ID NO:59)
QVAFTPYAPEPGSTCRLREYYDQTAQMC (SEQ ID NO:60)
AQVAFTPYAPEPGSTCRLREYYDQTAQMC (SEQ ID NO:61)
PAQVAFTPYAPEPGSTCRLREYYDQTAQMC (SEQ ID NO:62)
LPAQVAFTPYAPEPGSTCRLREYYDQTAQMC (SEQ ID NO:63);

and wherein R₅ represents a carboxy group of Cys¹¹⁵ or of carboxy-terminal amino acid residues selected from the group:

A
AP
APL
APLR (SEQ ID NO:64)
APLRK (SEQ ID NO:65)
APLRKC (SEQ ID NO:66)
APLRKCR (SEQ ID NO:67)

5 and variants thereof, provided however, when R₄ represents a methionylated or nonmethionylated amine group of amino acid sequence TCRLREYYDQTAQMC or an N-terminal truncation thereof of from 1 to 15 residues, then R₄-[Cys³²-Cys¹¹⁵]-R₅ is not an addition variant
10 having the formula R₄-[Cys³²-Cys¹¹⁵]-APLRKCR-R₆, wherein R₆ represents a carboxyl group of amino acid residues Pro¹²³-Thr¹⁷⁹ of Figure 8 or a carboxy-terminal truncation of Pro¹²³-Thr¹⁷⁹ of Figure 8.

15 4. The tumor necrosis binding protein according to any one of Claims 1 through 3, wherein said amino acid sequence is nonglycosylated.

20 5. The tumor necrosis binding protein according to any one of Claims 1 through 3, wherein said amino acid sequence is glycosylated.

25 6. The tumor necrosis binding protein according to any one of Claims 1 through 5, wherein the protein is conjugated to a water soluble polymer.

7. A polyvalent tumor necrosis binding protein comprising at least one tumor necrosis binding protein according to any one of Claims 1 through 6.

5 8. A polyvalent tumor necrosis binding protein having the formula R_1-X-R_2 , wherein:

X comprises a linker, wherein said linker is a water soluble polymer; and

R_1 and R_2 are biologically-active molecules covalently
10 bonded to said water soluble polymer, wherein at least one of R_1 and R_2 is a tumor necrosis binding protein according to any one of Claims 1 through 6.

9. The polyvalent tumor necrosis binding
15 protein of Claim 8, wherein the water soluble polymer is polyethylene glycol.

10. The polyvalent tumor necrosis binding protein of Claim 9, wherein the protein is selected from
20 the group consisting of sTNFR-I 2.6D/C105db and sTNFR-I 2.6D/C106db.

11. The tumor necrosis binding protein according to any one of Claims 1 through 10 for use in
25 treating TNF-mediated disease.

12. The tumor necrosis binding protein according to any one of Claims 1 through 10 for use in treating arthritis.

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13. A polynucleotide encoding the tumor necrosis binding protein according to any one of Claims 1 through 3.

14. A nucleic acid sequence comprising a tumor necrosis factor binding protein encoded by a nucleotide sequence selected from the following:

- (a) a cDNA sequence as shown in Fig. 2;
- (b) a cDNA sequence as shown in Fig. 3;
- (c) a cDNA sequence as shown in Fig. 4;
- (d) a cDNA sequence as shown in Fig. 5;
- (e) a cDNA sequence as shown in Fig. 6;
- (f) a cDNA sequence as shown in Fig. 7;
- (g) a sequence which is degenerate in the coding regions or portions thereof of (a), (b), (c), (d), (e) and (f);
- (h) a sequence which hybridizes to (a), (b), (c), (d), (e), (f) and (g); and
- (i) a sequence which is complementary to (a), (b), (c), (d), (e), (f), (g) and (h),

provided however, that the nucleic acid does not encode a protein having the formula
 $R_1\text{-[Cys}^{19}\text{-Cys}^{103}\text{]-FCCSLCL-R}_3$
wherein [Cys¹⁹-Cys¹⁰³] represents residues 19 through 103 of sTNFR-I, the amino acid residue numbering scheme of which is provided in Figure 1 (SEQ ID NO:2) to facilitate the comparison;
wherein R₁ represents a methionylated or nonmethionylated amine group of an amino acid sequence comprising NNSIC and R₃ represents a carboxyl group of amino acid residues Asn¹¹¹-Asn¹⁶¹ of Figure 1 or a carboxy-terminal truncation of Asn¹¹¹-Asn¹⁶¹ of Figure 1.

15. A polynucleotide having the sequence as set forth in Figures 2, 3, 4, 5, 6, or 7, or a portion thereof.

16. A vector comprising a polynucleotide of any one of Claims 13 through 15 operatively linked to an expression control sequence.

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17. A prokaryotic or eukaryotic host cell containing a polynucleotide of any one of Claims 13 through 15.

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18. A method comprising growing host cells of Claim 17 in a suitable nutrient medium and, optionally, isolating said truncated sTNFR from said cells or said nutrient medium.

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19. The method for producing the tumor necrosis binding protein according to Claim 18, wherein said host cells are *E. coli*.

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20. The method for producing the tumor necrosis factor binding protein according to Claim 18, wherein said host cells are Chinese hamster ovary cells.

21. A method comprising the steps of:

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- (a) culturing a prokaryotic or eukaryotic host cell of Claim 17;
- (b) maintaining said host cell under conditions allowing the expression of truncated sTNFR by said host cell; and
- (c) optionally isolating the truncated sTNFR expressed by said host cell.

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22. A tumor necrosis binding protein which is the recombinant expression product of a prokaryotic or eukaryotic host cell containing an exogenous polynucleotide of any one of Claims 13 through 15.

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23. A pharmaceutical composition comprising the tumor necrosis factor binding protein according to any one of Claims 1 through 10 in association with a
5 pharmaceutically acceptable vehicle.

24. A pharmaceutical composition comprising the tumor necrosis factor binding protein produced in accordance with the method of Claim 18 in association
10 with a pharmaceutically acceptable vehicle.

25. A pharmaceutical composition comprising the tumor necrosis factor binding protein produced in accordance with the method of Claim 21 in association
15 with a pharmaceutically acceptable vehicle.

26. A method of treating a TNF-mediated disease comprising administering to a patient the pharmaceutical composition of Claims 23 through 25.
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27. The method of claim 26, wherein the TNF-mediated disease is arthritis.

28. A method of preparing a pharmaceutical
25 composition wherein a therapeutically effective amount of the tumor necrosis factor binding protein according to any one of Claims 1 through 10 is mixed with one or more pharmaceutically acceptable vehicles.

29. The use of the tumor necrosis factor
30 binding protein according to any one of Claims 1 through 10 for treating a TNF-mediated disease.

30. The use of the tumor necrosis factor
35 binding protein according to Claim 29 for treating arthritis.

31. A kit for preparing an aqueous protein
formulation comprising the tumor necrosis factor binding
protein according to any one of Claims 1 through 10 and
5 a second container having a physiologically acceptable
solvent.